

**EDGEWOOD ARSENAL
TECHNICAL REPORT**

EATR 4647

**A SURVEY OF INTELLECTUAL AND
PERSONALITY TEST CORRELATES
IN US ARMY VOLUNTEER SUBJECTS**

by

James E. McCarroll, CPT, MSC

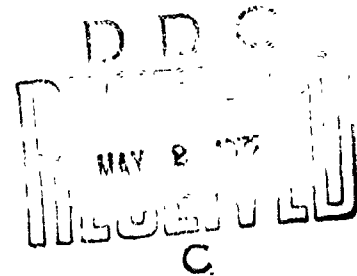
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April 1972



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1. ORIGINATING ACTIVITY (Corporate author) CO, EDGEWOOD ARSENAL ATTN: SMUEA-BL-RCO Edgewood Arsenal, Maryland 21010		2. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	
		2b. GROUP NA	
3. REPORT TITLE A SURVEY OF INTELLECTUAL AND PERSONALITY TEST CORRELATES IN US ARMY VOLUNTEER SUBJECTS			
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) This work was started in May 1970 and completed in February 1971.			
5. AUTHOR(S) (First name, middle initial, last name) James E. McCarroll, CPT, MSC Kragg P. Kysor			
6. REPORT DATE April 1972		7a. TOTAL NO. OF PAGES 17	7b. NO. OF REFS 7
8a. CONTRACT OR GRANT NO. b. PROJECT NO. c. Task No. 1W062116AD1901 d.		9a. ORIGINATOR'S REPORT NUMBER(S) EATR 4647 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
10. DISTRIBUTION STATEMENT Approved for public release; distribution unlimited.			
11. SUPPLEMENTARY NOTES Techniques of Evaluating Effects of Chemicals, Performance Evaluation of Chemically Exposed Personnel		12. SPONSORING MILITARY ACTIVITY NA	
13. ABSTRACT The Minnesota Multiphasic Personality Inventory (MMPI), California Personality Inventory (CPI), Wechsler Adult Intelligence Scale (WAIS), Bomber Facility (NF) test, Embedded Figures Test (EFT), and a portable Rod and Frame Test (RFT) were given to US Army enlisted men to obtain norms and intercorrelations of some of the tests. It was determined that: (1) the NF test is a valid predictor of numerical ability; (2) GT scores can be used as good predictors of WAIS intelligence; and (3) the EFT is more useful than the RFT for differentiating subjects into field dependence-independence.			
14. KEYWORDS Human performance testing MMPI CPI WAIS Intelligence NF test Embedded Figures Test Rod and Frame Test			

FORM 1473

REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE

UNCLASSIFIED

Security Classification

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James E. McCarroll, CPT, MSC
Kragg P. Kysor

Medical Research Division

April 1972

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Task !W062116AD1901

DEPARTMENT OF THE ARMY
EDGEWOOD ARSENAL
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FOREWORD

The work described in this report was authorized under Task 1W062116AD1901, Techniques of Evaluating Effects of Chemicals, Performance Evaluation of Chemically Exposed Personnel. This work was started in May 1970 and completed in February 1971.

The volunteers in these tests are enlisted US Army personnel. These tests are governed by the principles, policies, and rules for medical volunteers as established in AR 70-25.

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Acknowledgment

We wish to thank 1LT M. A. McColloch for administering some of the tests on this project.

DIGEST

The Minnesota Multiphasic Personality Inventory (MMPI), California Personality Inventory (CPI), Wechsler Adult Intelligence Scale (WAIS), Number Facility (NF) test, Embedded Figures Test (EFT), and a portable Rod and Frame Test (RFT) were given to US Army enlisted men to obtain norms and intercorrelations of some of the tests. It was determined that: (1) the NF test is a valid predictor of numerical ability; (2) GT scores can be used as good predictors of WAIS intelligence; and (3) the EFT is more useful than the RFT for differentiating subjects into field dependence-independence.

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A SURVEY OF INTELLECTUAL AND PERSONALITY TEST CORRELATES IN US ARMY VOLUNTEER SUBJECTS

I. INTRODUCTION.

This survey was performed: (1) to obtain a personality and intelligence profile of men participating in the medical volunteer program at this installation by using a broad range of psychological tests; (2) to evaluate certain psychological tests that might have potential for future research; and (3) to obtain norms for these tests.

Groups of 45 to 70 US Army enlisted men report to this installation as volunteer subjects for medical research projects every 2 months. The group for each 2-month period is from a different US Army area; the subjects used in this study, who reported between May 1970 and February 1971, were from the 1st, 3d, 4th, 5th, and 6th Army areas.

The measures studied included both routine tests currently administered upon in-processing the men and several new tests. The routine tests included the Minnesota Multiphasic Personality Inventory (MMPI), the Number Facility (NF) test, and the Verbal (VE) and Arithmetic (AR) Subtests of the Army Classification Battery (VE + AR = GT score). The new tests evaluated were the California Personality Inventory (CPI), the Wechsler Adult Intelligence Scale (WAIS), the Embedded Figures Test (EFT), and a portable Rod and Frame Test (RFT). Because the same tests had not been given to every subject, the number of subjects in each test group varied.

II. MEASURES STUDIED.

A. California Personality Inventory.

The CPI test was administered to as many volunteers as possible. The data collected here are compared with those described by Lavalley¹ for a sample of volunteers who reported to this installation in 1969. That profile and the one obtained by us are practically identical. The means of the scores for these two volunteer groups and a sample of male college students (as presented in the CPI manual) are given in table I.

The volunteers in both the 1969 and the 1970-1971 groups scored significantly lower (*t*-tests) than the college students on the Capacity for Status, Responsibility, Tolerance, Communality, Achievement via Independence, Flexibility, and Femininity scales. Those in the 1970-1971 group also scored significantly lower than the college group on the Socialization scale and lower than those in the 1969 group on the Intellectual Efficiency scale. Both volunteer groups scored significantly higher than the college men in the Good Impressions scale, and the 1970-1971 group also scored higher on the Sociability, Social Presence, Sense of Well Being, Self Control, and Psychological Mindedness scales.

The specific changes that may be represented by these increases and decreases would have to be determined from experimentation. Also, one should not attach too much importance to the fact that a large number of scales are significantly different statistically. With such large numbers of subjects one would expect statistical significance. Whether these differences are important behaviorally remains to be seen.

Although an average profile is helpful in describing the population as a whole, it does not say anything about the individual subject. As with the MMPI, however, certain profile types

¹Lavalley, R. J. EATR 4468. The California Psychological Inventory Profile of Enlisted Medical Research Volunteers. November 1970. UNCLASSIFIED Report.

Table I. CPI Means and Standard Deviations for College Men and Medical Volunteers in 1969 and 1971

Scale	1969, N = 120		1970-1971, N = 213		College men, N = 1133	
	Mean	SD	Mean	SD	Mean	SD
Dominance	26.4	8.5	28.0	6.5	28.3	6.3
Capacity for status	18.8 ^a	4.5	19.8 ^a	3.6	20.9	3.8
Sociability	26.4	4.8	26.8 ^b	4.4	25.4	5.0
Social presence	38.3	5.8	39.3 ^b	5.6	37.3	5.8
Self acceptance	21.8	3.5	22.3	3.7	22.3	3.8
Sense of well being	36.6	6.0	37.7 ^b	4.6	36.6	4.6
Responsibility	27.7 ^a	5.6	27.4 ^a	4.9	30.8	4.5
Socialization	35.8	5.8	35.3 ^a	5.3	36.8	5.2
Self control	29.3	9.2	30.1 ^b	7.0	27.6	7.5
Tolerance	20.1 ^a	5.8	21.6 ^a	5.0	23.3	4.8
Good impressions	19.9 ^b	6.8	19.8 ^b	6.2	17.2	6.2
Communality	24.5 ^a	3.3	24.6 ^a	3.4	25.5	2.0
Achievement via conformance	26.9	5.1	26.7	4.7	27.4	4.5
Achievement via independence	17.6 ^a	4.7	19.0 ^a	4.4	20.9	4.2
Intellectual efficiency	37.5 ^a	6.2	39.0	5.6	39.8	5.0
Psychological mindedness	11.5	3.1	12.2 ^b	2.6	11.4	3.0
Flexibility	8.9 ^a	3.9	9.9 ^a	4.2	11.1	3.8
Femininity	15.6 ^a	3.4	15.3 ^a	3.3	16.7	3.7

^a $p < 0.05$; medical volunteers scored significantly lower than college men.

^b $p < 0.05$; medical volunteers scored significantly higher than college men.

probably, can be expected to occur reliably from group to group if an investigator wished to study a particular profile type. Certain studies with MMPI profile types have already been completed in which it was found that effects differ depending upon the profile type tested.^{2,3}

Studies have been performed correlating the CPI score with response to scopolamine.⁴ The CPI was found to be significantly related to some categories of short-term memory and seems to show promise for future research in this area. In addition, if the CPI forms were available in all volunteer records, an ad hoc study could be performed at some later time.

B. Wechsler Adult Intelligence Scale.

The WAIS was administered to a random sample of each group of volunteers ($N = 38$). The results of the WAIS were correlated with the VE, AR, and GT scores of the Army Classification

²Klapper, J. A., and McColloch, M. A. EATR 4553. Personality and Reactivity to Tranquilizers. September 1971. UNCLASSIFIED Report.

³Klapper, J. A., McColloch, M. A., and Merkey, R. P. EATR 4577. The Relationship of Personality to Tolerance of an Irritant Compound. November 1971. UNCLASSIFIED Report.

⁴McCarroll, J. E. EATR 4653. The Effects of Scopolamine and Atropine on the Delayed Recall of Numbers. In preparation. UNCLASSIFIED Report.

Battery, as well as the NF, EFT, and RFT tests. A correlation of GT and/or NF tests and WAIS scores would be helpful in selecting men with a particular intellectual level or skill (e.g., number, perceptual, verbal, etc.) because it would be impractical to administer the WAIS test to large numbers of men. The distribution of WAIS IQ scores obtained is presented in table II.

A correlation of 0.80 was found between the GT score and the WAIS IQ score (see table III). Also, the intercorrelations of the WAIS subtests were computed (see table IV for correlation matrix). The correlations between the WAIS and the GT scores should be of interest Army-wide because the GT is given to every enlisted man. From an examination of the correlations in table III, it appears that the AR, VE, and GT correlate well with WAIS verbal subtests, but poorly with performance as measured by the WAIS. The VE and AR parts of the GT differ only on one of the significant WAIS subtest correlations. Thus, the GT test appears

Table II. Distribution of WAIS IQ Scores

IQ	Number
90-99	9
100-109	14
110-119	15
120-125	5

Median = 108
Range = 90-125

to correlate well with general intelligence, particularly the verbal subtests, but is not predictive of some performance skills, as measured by the WAIS. The investigator who wishes to group subjects on the basis of some particular performance capacity should not use the GT, but rather a specific test that suits his design.

C. Number Facility Test.

The NF test⁵ frequently is used as a measure of cognitive ability after some treatment (e.g., sedative drugs) to attempt to detect a deficit in performance. The NF test consists of 20 alternate forms of 90 simple arithmetic problems. The subject's task is to work as many problems as possible in a 3-minute period. One way to score this test is to compute a baseline score on the basis of a subject's pretest performance, and any decrements caused by a treatment are expressed as a percentage of this baseline. The question of the validity of the NF might be answered by correlating NF results with the results of other tests. If the NF were found to correlate with some measure of arithmetic ability, one might say that it is a valid test of number facility. Correlations were computed between baseline NF scores (mean of 20 tests) and the WAIS subtests ($N = 35$) as shown in table III. Significant correlations were found between NF and Arithmetic and between NF and Digit Span. On the basis of these results, the NF is valid; that is, it is a measure of a subject's ability to perform simple arithmetic. However, it does not appear to correlate well with general intelligence.

The NF test also was compared with the CPI ($N = 35$) to see whether it could be correlated with some aspect of personality other than intelligence. The only significant correlation was with the Social Presence scale. This could indicate that persons who score high on the NF are quick, active, and attack the NF test in a vigorous manner, whereas low scorers are more deliberate, slow, and uncertain. Along the same line, this result may simply indicate that well-motivated subjects do well on the NF test, which is not surprising.

D. Embedded Figures Test and Rod and Frame Test.

Two other tests were given to the volunteers, the EFT and the RFT. The EFT consists of 12 complex colored patterns, each of which contains a simple pattern. The subject's job is to locate the simple pattern in the complex pattern. The RFT used in this test consists of a luminous square

⁵Moran, L. J., and Mefford, R. B. Repetitive Psychometric Measures. Psychol. Rep. 5, 269-275 (1959).

Table III. Correlations of WAIS Subtests With VE, AR, GT, NF, EFT, and RFT Tests

WAIS subtests	VE (N = 38)	AR (N = 38)	GT (N = 38)	NF (N = 35)	EFT (N = 30)	RFT (N = 36)
Information	0.68 ^a	0.63 ^a	0.73 ^a	0.09	0.34	0.26
Comprehension	0.56 ^a	0.56 ^a	0.63 ^a	-0.14	-0.30	-0.10
Arithmetic	0.36 ^b	0.67 ^a	0.57 ^a	0.35 ^b	-0.18	0.00
Similarities	0.36 ^b	0.54 ^a	0.50 ^a	0.26	0.00	0.08
Digit span	0.31	0.30	0.34 ^b	0.37 ^b	0.01	-0.12
Vocabulary	0.76 ^a	0.55 ^a	0.73 ^a	-0.18	-0.13	-0.03
Digit symbol	0.14	0.31	0.25	0.32	-0.02	-0.32 ^b
Picture completion	0.19	0.23	0.24	0.25	-0.18	-0.13
Block design	0.41 ^b	0.41 ^b	0.45 ^a	0.21	-0.45 ^b	-0.33 ^b
Picture arrangement	0.39 ^b	0.30	0.38 ^b	0.02	-0.06	-0.14
Object assembly	0.29	0.14	0.22	-0.06	-0.40 ^b	-0.22
Verbal IQ	0.71 ^a	0.74 ^a	0.81 ^a	0.22	-0.23	-0.41 ^b
Performance IQ	0.48 ^a	0.50 ^a	0.54 ^a	0.23	-0.42 ^b	-0.03
Full scale IQ	0.72 ^a	0.72 ^a	0.80 ^a	0.23	-0.39 ^b	-0.25

^a $p < 0.01$.^b $p < 0.05$.

Table IV. Intercorrelations of WAIS Subtests (N = 38)

WAIS subtests	Information	Comprehension	Arithmetic	Similarities	Digit span	Vocabulary	Digit symbol	Picture completion	Block design	Picture arrangement	Object assembly	Verbal IQ	Performance IQ
Comprehension	0.70 ^a												
Arithmetic	0.43 ^a	0.43 ^a											
Similarities	0.66 ^a	0.38 ^b	0.42 ^a										
Digit span	0.15	0.00	0.35 ^b	0.18									
Vocabulary	0.65 ^a	0.56 ^a	0.35 ^b	0.39 ^b	0.19								
Digit symbol	0.26	0.25	0.21	0.11	-0.03	0.14							
Picture completion	0.37 ^b	0.35 ^b	0.08	0.20	0.06	0.25	0.26						
Block design	0.44 ^a	0.44 ^a	0.22	0.29	0.07	0.21	0.38 ^b	0.41 ^b					
Picture arrangement	0.18	0.26	0.14	0.26	0.06	0.30	0.01	0.00	0.10				
Object assembly	0.25	0.26	0.07	0.22	0.08	0.21	-0.03	0.43 ^a	0.45 ^a	0.11			
Verbal IQ	0.80 ^a	0.70 ^a	0.68 ^a	0.70 ^a	0.47 ^a	0.75 ^a	0.17	0.28	0.41 ^b	0.33 ^b	0.27		
Performance IQ	0.48 ^a	0.50 ^a	0.26	0.39 ^b	0.13	0.40 ^b	0.46 ^a	0.62 ^a	0.72 ^a	0.49 ^a	0.67 ^a	0.52 ^a	
Full scale IQ	0.69 ^a	0.65 ^a	0.51 ^a	0.52 ^a	0.37 ^b	0.70 ^a	0.33 ^b	0.46 ^a	0.60 ^a	0.46 ^a	0.47 ^a	0.84 ^a	0.79 ^a

^a $p < 0.01$.^b $p < 0.05$.

(frame) 7 by 7 inches and a line (7-inch rod) contained in a movable plate. The rod and frame can be rotated to an angle of 20° to right and left of center. The subject's job is to adjust the rod so it is in a vertical (0°) position.

Each of these tests supposedly measures the construct of field independence-dependence,⁶ which is, briefly, the ability of a person to perceive a figure and resist the influence of background stimulation. This ability (or inability in the case of the field-dependent person) has broad implications for personality and interpersonal interaction situations. For example, the field-dependent person is more easily influenced by other persons and events than the field-independent person. Most likely, field-independent and field-dependent subjects would respond differently to some treatment variable, e.g., drugs.

Subjects were administered the EFT and the RFT to determine whether they could, in fact, be differentiated into field-dependent and field-independent groups on the basis of these tests. A second purpose was to compare the two tests to see whether either appeared to be superior. The EFT was administered according to the manual.⁷ The Rod and Frame Test used was a portable apparatus (Research Media, Inc., model PR-20).

No correlation was found between the two methods ($N = 30$). It is felt that they might be measuring different abilities, although some correlation was expected. The EFT and RFT scores were also correlated with the CPI, MMPI, WAIS, and NF. No correlations were found between the CPI or MMPI and the two measures of field dependence. The Block Design subtest of the WAIS was negatively correlated with both the EFT and the RFT (table III), indicating that both are measuring field independence-dependence. Significant negative correlations were also found between EFT and Object Assembly and between RFT and Digit Symbol. There was a nonsignificant correlation between the EFT and NF tests. However, there was a significant negative correlation between the RFT and the NF ($r = -0.70$, $p < 0.01$). This indicates that persons who score high on the NF test tend to have a low deviation on the RFT, indicating more field-independence. This high correlation requires further research before a good interpretation can be made. The RFT was deemed not to be as useful as the EFT for differentiating subjects into field-dependent and field-independent for several reasons. It is difficult to administer, and the range of scores is very narrow compared to the EFT. Also, one is not certain what is measured by the RFT. Because the EFT has been studied much more thoroughly, better comparisons and continuity would result from use of the EFT, particularly in elucidating the concepts of field dependence-independence and drug effects.

The distribution of scores on the EFT is given in table V. As can be seen, the distribution is very high centrally, making it necessary to test many subjects in order to obtain sizeable field-independent groups. We do feel it would be worthwhile to do such a study, however, because different personality types often have different reactions to drugs. The authors are not aware of any study of this kind having been performed. It would be interesting to see how two very different personality types would react to the same drug, e.g., scopolamine, in the same setting.

III. CONCLUSIONS.

The NF test is a valid predictor of one aspect of intelligence: numerical ability.

The GT scores can be used as good predictors of intelligence as measured by the WAIS.

⁶Witkin, H. A. Individual Differences in Ease of Perception of Embedded Figures. *J. Personality* 19, 1-15 (1950).

⁷Witkin, H. A. Temporary Manual: The Embedded Figures Test. Consulting Psychologists Press, Inc., Palo Alto, California, 1969.

The EFT can be used to differentiate the pool of subjects used locally on the basis of field dependence-independence and for this purpose is considered a better test than the RFT.

Table V. Frequency Distribution of EFT Scores

Number of subjects	Scores
	<i>sec</i>
1	18-198
3	199-378
8	379-558
7	559-738
8	739-918
1	919-1098
2	1099-1278

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